

Claims

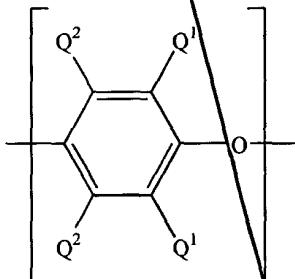
[c1]

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1. A thermoplastic composition, comprising:
a poly(arylene ether);
a poly(alkenyl aromatic) resin in an amount of at least about 30 weight percent of the total of the poly(arylene ether) and the poly(alkenyl aromatic) resin;
a polyolefin;
a hydrogenated block copolymer of an alkenyl aromatic compound and a conjugated diene, wherein the hydrogenated block copolymer has an alkenyl aromatic content of about 40 to about 90 weight percent; and
an unhydrogenated block copolymer of an alkenyl aromatic compound and a conjugated diene.

[c2]

2. The thermoplastic composition of Claim 1, wherein the poly(arylene ether) comprises a plurality of structural units of the formula



wherein for each structural unit, each Q^1 is independently halogen, primary or secondary $C_1 - C_8$ alkyl, phenyl, $C_1 - C_8$ haloalkyl, $C_1 - C_8$ aminoalkyl, $C_1 - C_8$ hydrocarboxy, or $C_2 - C_8$ halohydrocarboxy wherein at least two carbon atoms separate the halogen and oxygen atoms; and each Q^2 is independently hydrogen, halogen, primary or secondary $C_1 - C_8$ alkyl, phenyl, $C_1 - C_8$ haloalkyl, $C_1 - C_8$ aminoalkyl, $C_1 - C_8$ hydrocarboxy, or $C_2 - C_8$ halohydrocarboxy wherein at least two carbon atoms separate the halogen and oxygen atoms.

[c3]

3. The thermoplastic composition of Claim 2, wherein each Q^1 is independently $C_1 - C_4$ alkyl or phenyl, and each Q^2 is independently hydrogen or methyl.

[c4]

4. The thermoplastic composition of Claim 1, wherein the poly(arylene ether) has an intrinsic viscosity of about 0.2 to about 0.6 dL/g as measured in chloroform at 25 °C.

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[c5] 5. The thermoplastic composition of Claim 1, wherein the poly(arylene ether) comprises a copolymer of 2,6-dimethylphenol and 2,3,6-trimethylphenol.

[c6] 6. The thermoplastic composition of Claim 1, comprising about 10 to about 59 weight percent poly(arylene ether), based on the total weight of the composition.

[c7] 7. The thermoplastic composition of Claim 1, wherein the poly(alkenyl aromatic) resin comprises at least 25% by weight of structural units derived from an alkenyl aromatic monomer of the formula

$$\begin{array}{c} R^1-C=CH_2 \\ | \\ \text{C}_6\text{H}_4-\text{Z}- \\ | \\ (Z)_p \end{array}$$

wherein R^1 is hydrogen, C_1-C_8 alkyl, or halogen; Z is vinyl, halogen, or C_1-C_8 alkyl; and p is 0 to 5.

[c8] 8. The thermoplastic composition of Claim 1, wherein the poly(alkenyl aromatic) resin comprises at least one poly(alkenyl aromatic) resin selected from the group consisting of atactic homopolystyrene, syndiotactic homopolystyrene, rubber-modified polystyrene, and mixtures comprising at least one of the foregoing poly(alkenyl aromatic) resins.

[c9] 9. The thermoplastic composition of Claim 1, comprising about 4 to about 46 weight percent poly(alkenyl aromatic) resin, based on the total weight of the composition.

[c10] 10. The thermoplastic composition of Claim 1, wherein the polyolefin comprises a homopolymer or copolymer having at least about 80 weight percent of units derived from polymerization of ethylene, propylene, butylene, or a mixture thereof.

[c11] 11. The thermoplastic composition of Claim 1, wherein the polyolefin is a propylene polymer; and wherein the propylene polymer is a homopolymer of polypropylene, or a random, graft, or block copolymer of propylene and at least one olefin selected from ethylene and C_4-C_{10} alpha-olefins, with the proviso

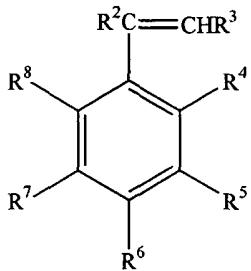
that the copolymer comprises at least about 80 weight percent of repeating units derived from propylene.

[c12] 12. The thermoplastic composition of Claim 1, wherein the polyolefin comprises a homopolypropylene.

[c13] 13. The thermoplastic composition of Claim 1, comprising about 10 to about 70 weight percent of the polyolefin, based on the total weight of the composition.

[c14] 14. The thermoplastic composition of Claim 1, wherein the hydrogenated block copolymer comprises:

(A) at least one block derived from an alkenyl aromatic compound having the formula



wherein R² and R³ each represent a hydrogen atom, a C₁–C₈ alkyl group, or a C₂–C₈ alkenyl group; R⁴ and R⁵ each represent a hydrogen atom, a C₁–C₈ alkyl group, a chlorine atom, or a bromine atom; and R⁶–R⁸ independently represent a hydrogen atom, a C₁–C₈ alkyl group, or a C₂–C₈ alkenyl group, or R⁴ and R⁵ are taken together with the central aromatic ring to form a naphthyl group, or R⁵ and R⁶ are taken together with the central aromatic ring to form a naphthyl group including; and

(B) at least one block derived from a conjugated diene, in which the aliphatic unsaturated group content in the block (B) is reduced by hydrogenation.

[c15] 15. The thermoplastic composition of Claim 1, wherein the hydrogenated block copolymer comprises a styrene-(ethylene-butylene)-styrene triblock copolymer.

[c16] 16. The thermoplastic composition of Claim 1, wherein the hydrogenated block copolymer has a styrene content of about 50 to about 85 weight percent.

[c17] 17. The thermoplastic composition of Claim 1, wherein the hydrogenated block copolymer has a styrene content of about 55 to about 70 weight percent.

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[c18] 18. The thermoplastic composition of Claim 1, comprising about 1 to about 20 weight percent of the hydrogenated block copolymer, based on the total weight of the composition.

[c19] 19. The thermoplastic composition of Claim 1, wherein the unhydrogenated block copolymer comprises a styrene-butadiene diblock copolymer, a styrene-butadiene-styrene triblock copolymer, or a styrene-butadiene radial teleblock copolymer.

[c20] 20. The thermoplastic composition of Claim 1, comprising about 1 to about 20 weight percent of the unhydrogenated block copolymer.

[c21] 21. The thermoplastic composition of Claim 1, further comprising a hydrogenated block copolymer of an alkenyl aromatic compound and a conjugated diene, wherein the hydrogenated block copolymer has an alkenyl aromatic content of about 10 to less than 40 weight percent.

[c22] 22. The thermoplastic composition of Claim 1, further comprising a polypropylene-polystyrene graft copolymer.

[c23] 23. The thermoplastic composition of Claim 22, wherein the polypropylene-polystyrene graft copolymer comprises a graft copolymer having a propylene polymer backbone and one or more styrene polymer grafts.

[c24] 24. The thermoplastic composition of Claim 23, wherein the polypropylene-polystyrene graft copolymer comprises about 10 to about 90 weight percent of the propylene polymer backbone and about 90 to about 10 weight percent of the styrene polymer grafts.

[c25] 25. The thermoplastic composition of Claim 22, comprising about 0.5 to about 15 weight percent of the polypropylene-polystyrene graft copolymer, based on the total weight of the composition.

[c26] 26. The thermoplastic composition of Claim 1, further comprising an ethylene/alpha-olefin elastomeric copolymer.

[c27] 27. The thermoplastic composition of Claim 26, wherein the ethylene/alpha-

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olefin elastomeric copolymer comprises a copolymer of ethylene and at least one C₃ - C₁₀ alpha-olefin.

[c28] 28. The thermoplastic composition of Claim 26, wherein the ethylene/alpha-olefin elastomeric copolymer comprises an ethylene-butylene rubber, an ethylene-propylene rubber, or a mixture thereof.

[c29] 29. The thermoplastic composition of Claim 26, comprising about 1 to about 20 weight percent of the ethylene/alpha-olefin elastomeric copolymer.

[c30] 30. The thermoplastic composition of Claim 1, further comprising at least one additive selected from the group consisting of stabilizers, mold release agents, processing aids, flame retardants, drip retardants, nucleating agents, UV blockers, dyes, pigments, particulate fillers, reinforcing fillers, conductive fillers, anti-static agents, blowing agents, and antioxidants.

[c31] 31. The thermoplastic composition of Claim 1, wherein the composition is substantially free of reinforcing fillers.

[c32] 32. The thermoplastic composition of Claim 1, wherein the composition after molding has less than about 10% batch-to-batch variability in Izod Notched Impact Strength at 23 ° C measured according to ASTM D256.

[c33] 33. The thermoplastic composition of Claim 1, wherein the composition after molding has less than about 5% batch-to-batch variability in Flexural Modulus at 23 ° C measured according to ASTM D790.

[c34] 34. The composition of Claim 1, wherein the composition after molding has a flexural modulus at 23 ° C greater than about 100 kpsi and an Izod notched impact strength greater than about 1 ft-lb/in.

[c35] 35. A thermoplastic composition, comprising:
a poly(arylene ether);
a poly(alkenyl aromatic) resin;
a polyolefin;
a hydrogenated block copolymer of an alkenyl aromatic compound and a conjugated diene, wherein the hydrogenated block copolymer has an alkenyl

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aromatic content of about 40 to about 90 weight percent; and
an unhydrogenated block copolymer of an alkenyl aromatic compound and a
conjugated diene;
wherein the poly(arylene ether) and the poly(alkenyl aromatic) resin form a
single phase having a glass transition temperature at least about 20 °C greater
than the glass transition temperature of the poly(alkenyl aromatic) resin alone.

[c36] 36. A thermoplastic composition, comprising:
a poly(arylene ether);
a poly(alkenyl aromatic) resin;
a polyolefin;
a hydrogenated block copolymer of an alkenyl aromatic compound and a
conjugated diene, wherein the hydrogenated block copolymer has an alkenyl
aromatic content of about 40 to about 90 weight percent; and
an unhydrogenated block copolymer of an alkenyl aromatic compound and a
conjugated diene;
wherein the poly(arylene ether) and the poly(alkenyl aromatic) resin form a
single phase having a glass transition temperature up to about 15 °C greater
than the melting temperature of the polyolefin alone.

[c37] 37. A thermoplastic composition, comprising:
a poly(arylene ether);
a poly(alkenyl aromatic) resin;
a polyolefin;
a hydrogenated block copolymer of an alkenyl aromatic compound and a
conjugated diene, wherein the hydrogenated block copolymer has an alkenyl
aromatic content of about 40 to about 90 weight percent; and
an unhydrogenated block copolymer of an alkenyl aromatic compound and a
conjugated diene;
wherein the poly(arylene ether) and the poly(alkenyl aromatic) resin form a
single phase having a glass transition temperature of about 130 °C to about
180 °C.

[c38] 38. A thermoplastic composition, comprising:

a poly(arylene ether);
a poly(alkenyl aromatic) resin;
a polyolefin;
a hydrogenated block copolymer of an alkenyl aromatic compound and a conjugated diene, wherein the hydrogenated block copolymer has an alkenyl aromatic content of about 40 to about 90 weight percent;
an unhydrogenated block copolymer of an alkenyl aromatic compound and a conjugated diene; and
a polypropylene-polystyrene graft copolymer or an unhydrogenated block copolymer of an alkenyl aromatic compound and a conjugated diene.

[c39] 39. A thermoplastic composition, comprising:
about 10 to about 59 weight percent of a poly(arylene ether);
about 3 to about 46 weight percent of a poly(alkenyl aromatic) resin, with the proviso that the weight ratio of the poly(alkenyl aromatic) resin to the poly(arylene ether) is at least about 3:7;
about 10 to about 70 weight percent of a polyolefin;
about 1 to about 20 weight percent of a hydrogenated block copolymer of alkenyl aromatic compound and a conjugated diene, wherein the hydrogenated block copolymer has an alkenyl aromatic content of about 40 to about 90 weight percent; and
about 1 to about 20 weight percent of an unhydrogenated block copolymer of an alkenyl aromatic compound and a conjugated diene;
wherein all weight percents are based on the total weight of the composition.

[c40] 40. A thermoplastic composition, comprising:
about 10 to about 59 weight percent of a poly(arylene ether);
about 1 to about 46 weight percent of a poly(alkenyl aromatic) resin;
about 10 to about 70 weight percent of a polyolefin;
about 1 to about 20 weight percent of a hydrogenated block copolymer of alkenyl aromatic compound and a conjugated diene, wherein the hydrogenated block copolymer has an alkenyl aromatic content of about 40 to about 90 weight percent;
about 1 to about 20 weight percent of an unhydrogenated block copolymer of

an alkenyl aromatic compound and a conjugated diene; and
about 0.5 to about 15 weight percent of a polypropylene-polystyrene graft
copolymer;
wherein all weight percents are based on the total weight of the composition.

[c41] 41. A thermoplastic composition, comprising:
about 10 to about 59 weight percent of a poly(arylene ether);
about 1 to about 46 weight percent of a poly(alkenyl aromatic) resin;
about 1 to about 20 weight percent of an unhydrogenated block copolymer of
alkenyl aromatic compound and a conjugated diene;
about 10 to about 70 weight percent of a polyolefin;
about 1 to about 20 weight percent of an ethylene/alpha-olefin elastomeric
copolymer;
about 1 to about 20 weight percent of a hydrogenated block copolymer of
alkenyl aromatic compound and a conjugated diene, wherein the hydrogenated
block copolymer has an alkenyl aromatic content of about 40 to about 90
weight percent; and
about 0.5 to about 15 weight percent of a polypropylene-polystyrene graft
copolymer;
wherein all weight percents are based on the total weight of the composition.

[c42] 42. A thermoplastic composition, comprising the reaction product of:
a poly(arylene ether);
a poly(alkenyl aromatic) resin in an amount of at least about 30 weight percent
of the total of the poly(arylene ether) and the poly(alkenyl aromatic) resin;
a polyolefin;
a hydrogenated block copolymer of an alkenyl aromatic compound and a
conjugated diene, wherein the hydrogenated block copolymer has an alkenyl
aromatic content of about 40 to about 90 weight percent; and
an unhydrogenated block copolymer of an alkenyl aromatic compound and a
conjugated diene.

[c43] 43. An article comprising the composition of Claim 42.

[c44] 44. An article comprising the composition of Claim 42, wherein the article is

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formed using at least one method selected from the group consisting of injection molding, blow molding, extrusion, sheet extrusion, film extrusion, profile extrusion, pultrusion, compression molding, thermoforming, pressure forming, hydroforming, vacuum forming, and foam molding.

[c45] 45. An article comprising the composition of Claim 42, wherein the article is formed using blow molding or foam molding.

[c46] 46. A sheet comprising the composition of Claim 42.